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THE EQUIPMENT OF A PSYCHOLOGICAL LABORATORY.

By E. B. TITCHENER.

In *Mind* for July, 1898, I published a paper, entitled "A Psychological Laboratory," in which I gave a brief account of the plan, resources and aims of the Cornell laboratory.¹ Reference was made in the paper to an 'ideal' psychological labor-

¹ A few remarks supplementary to this paper may be made here. (1) We have found it necessary to exclude blackboards, however patent the writing chalk employed, from all rooms but the lecture and work rooms. The chalk dust is inevitable, and extremely penetrating. (2) All floors but one, throughout the laboratory, are of soft wood, oiled. The exception (hard wood, varnished) has proved unsatisfactory. (3) The dark-room lantern window (p. 319 of the *Mind* article) has been cut, and the arrangement works very well. (4) The direct current leads (p. 319) have been extended to five more rooms. (5) In the *Psychological Review* for November, 1898, Professor Cattell offers objection to some of our arrangements. Thus, he regards the "estimate of \$300 annually for current expenses" as "rather extravagant." The objection is surely based upon a misunderstanding. All that my paper says (pp. 326-7) is that it is unsafe to begin the working year with a less sum than \$300 in hand,—unsafe to have anticipated the year's income by purchases to the amount of more than \$300; while it expressly states, further, that whatever remains at the end of the year goes to the procurement of research instruments. Probably the term 'current expenses,' though carefully safeguarded, proved misleading. Again, Professor Cattell urges the advantage, for research, of small closet-like rooms. Here I heartily agree with him, and, indeed, had previously introduced the feature into some of the lesser laboratories that I have helped to plan. We have, moreover, repeatedly canvassed the question of such rooms for the Cornell laboratory. Unfortunately, the functions of the laboratory are such as to preclude the required subdivision. Again, there is an advantage in "setting up all the work on vision in one room"—an advantage so obvious that I am surprised at the objection. The coloring and lighting of the room alone, *e. g.*, would justify the procedure. Again, the objection that a "flock of twenty students" must be driven successively into several rooms presupposes that all students in the drill-course are performing the same experiment at the same time. I should regard this as a mistake, whether considered from the student's or the instructor's point of view. It is not our method. Lastly, the objection that the smell and taste room "is not needed for an hour's instruction in the course of the year" seems to me woefully to underestimate—and the underestimation is not uncommon among experimental psychologists—the place of these two senses in a course of laboratory work. Our taste and smell room is occupied as often and as long as any other of the rooms used in the drill-course.

atory, and to the necessity of our having, some day or other, 'special buildings' for the housing of our instruments. I also expressed the hope of issuing, within a year or two, "a pamphlet containing a full list of the pieces that we [at Cornell] possess, with makers and prices, and stating briefly the results of our experience with them." Although the laboratory is not yet completed upon the twelve-room basis, and although the various schemes thought of for an ideal laboratory have not yet matured into anything that could be put into an architect's hands, it still seems worth while, in view of the interest that the preliminary discussion has aroused, to print our inventory as it stands, and to outline the general conclusions that we have reached concerning the laboratory of the future.

I. *Suggestions towards the Plan of a Psychological Laboratory.* The psychological laboratory should be conceived of as a three-story building, with attics and basement. On the ground floor I should place first, to the right, the large auditorium, a room capable of seating, say, 300 persons. This room should be accessible by a special outside stairway, and also by a passage-way behind the lecturer's table. Across this passage-way should lie the museum room, a room devoted to the display of historical instruments, the storage of the demonstration-pieces required for lecture courses, and the safe-keeping of all apparatus not actually in use in the laboratory. The plan of leaving instruments, that are now lying idle, in the places where they were last used, seems to me to be bad even in a research laboratory, but doubly bad in a teaching laboratory. It relieves the student of the wholesome labor of taking-down and casing, and it inculcates a general slovenliness and lack of method in experimental work.—An elevator should run up and down from the museum room.

The left-hand portion of the ground floor would then contain the library; a seminary room, with the Director's office opening into it; and, if space allowed, a general writing-room. This last is a room in which talking is permitted, and which students would utilize for the writing-up of experimental records immediately after the taking of an experimental series.

The second floor represents the drill-laboratory. For this I can think of no better plan of arrangement than that which I have tried to follow in my own laboratory. For optics, there should be two rooms, light and dark, facing south and north respectively, and the latter divided into antechamber and inner room. For acoustics, there should be one large room, connected directly with a small, dark and (so far as is possible without special construction) sound-proof chamber. For haptics, there should be a moderately sized room, devoted to work on cutaneous pressure, temperature, and pain, and a larger

room for investigations of the movement perceptions. Taste and smell should each have a small room, the latter tiled or glazed, and so situated that ventilation is easy and does not involve the opening of doors or transom-windows into the building. There should, further, be a clock-room, for the time-registering instruments and their controls; and a large room for the investigation of the bodily processes and changes underlying affective consciousness (pulse, breathing, muscular strength, involuntary muscular movement, bodily volume). It would also be necessary, I imagine, to have on this floor one or two small lecture-rooms, and private rooms for the instructors.

The third floor represents the research laboratory. The main feature of this would be a group of a dozen or twenty cells, large enough to take ordinary research apparatus and two persons, arranged round a common court or vestibule. There should also be a series of half-a-dozen small dark rooms (optics). I am not certain whether an attempt should be made to build an absolutely sound-proof acoustics room. There are grave mechanical difficulties, over and above the difficulty of ventilation, in the way. Moreover, recent work has shown that we attend to a given stimulus better if we are under a slight 'distraction' than we do if all distractions are ruled out of the experiment. Unless, then, the sound-proof room be itself an object of investigation,—unless we desire to know, for some definite reason, what consciousnesses occur under soundless conditions,—I incline to doubt the advisability of including this room in the scheme of the laboratory. On the other hand, the acoustics quarter should certainly be isolated by a wide passage-way from the rest of the floor, and by double ceilings from the floors above and below. The remaining space upon this floor would be filled by the clock room, a couple of large rooms kept free for such researches as demanded bulky apparatus (static sense, *e. g.*), and the private laboratories of the officers of instruction.

The attic space could be used for photography, for experimental work upon the smaller animals, and for general storage. The basement would contain the laboratory workshops, and rooms for experimental work upon larger animals. At one corner of the building, and separated by the workshops from the animal quarter, there should be a tiled room for research work in olfactometry.¹ The elevator would pass from the workshops through the museum room to the open court of the third floor.

Such, in the very barest of outline sketches, is my plan for

¹ I am very doubtful as to the position of this room, essential as the room is. Perhaps it should be placed upon the third floor.

the 'ideal' laboratory. Crude as it is, it may, perhaps, serve as a basis for future discussion. Experimental psychology is advancing so steadily along the beaten paths, is developing so many new branches, and, above all, is holding out so bravely against pedagogical and philosophical attack, that the realization of a laboratory on the scale indicated can but be a matter of time.

II. *The Equipment of the Cornell Laboratory.* The following list shows the resources of the Cornell laboratory at the present time. The classification is, to some extent, arbitrary; one and the same instrument may play a part in half-a-dozen different investigations. Where two names follow a number, the first is the name of the inventor, the second that of the manufacturer. In no case does the price given include carriage. All the pieces listed have been tested in the laboratory, either in research or in drill-work; and we are ready, upon personal application, to give the results of our experience with any of them.

A word of caution may, however, be in place here. Existing psychological laboratories bear upon them, very plainly, a personal and individual mark. We shall presently shake down into some sort of uniformity; but at present the range of variation is wide. Hence it will be well for intending purchasers to consult with the directors of two or three laboratories, rather than with one only. For example: the Hering indirect-vision color-mixer, a piece which is hardly ever out of use in the Cornell laboratory, is not used at all in certain other of the larger American laboratories which possess it. So the Ellis-Helmholtz harmonical, an apparatus of capital importance in our eyes, receives but a slighting mention in a recent paper by the Director of the Yale laboratory. On the other hand, I have seen the Baltzar interrupter-clock playing a much larger part in general laboratory economy than it does at Cornell. It will not be entirely expedient, then, to trust to the experience of a single university, unless the course of instruction there given is to be pretty closely followed. With this preface we may proceed to the list itself.

A. PHYSIOLOGICAL AND PSYCHOLOGICAL ACOUSTICS.

I. Anatomy and Physiology of the Auditory Organ.

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|---|-----------------------|------------|
| 1. Large elastic model of human ear. | Auzoux. | Fr. 200.00 |
| 2. Two large plaster models of internal ear of man. | Ste-
ger. | Mk. 20.00 |
| 3. Mechanical model of drum-skin and ossicles. | Helm-
holtz. Jung. | Mk. 50.00 |

See also H, III and IV.

II. Auditory Sensation : Intensity.

4. Acoumeter. Politzer. Meyrowitz.	\$2.75
5. Triple fall-phonometer. Titchener. Willyoung.	\$50.00
6. Quadruple sound-pendulum. Titchener. Francis.	\$100.00
7. Brass piston-whistle for demonstrating proper tone of auditory passages. Vs. 1,024-4,096, in semitones. Willyoung.	\$5.00

III. Auditory Sensation : Quality and Clang-tint.

8. Model of piano key-board, with attachments showing direct clang-relationship. After Mach. Made in Ithaca.	\$3.00
9. Collection of instruments for study of clang-tint: 5 mouth-harmonicas, 1 pan-pipes, 3 jewsharps, 3 whistles, 1 bagpipes, 3 ocharinas, 2 oboes, 3 cymbals.	\$7.50
10. Bellows-table, with regulator, wind-chest and key-board for 13 pipes. Koenig. Kohl.	Mk. 400.00
11. 9 open wooden pipes, with manometric attachments, for use with above: $c-c^1$ (c^1 duplicated). Koenig. Kohl.	ca. Mk. 60.00
12. Wind-chest with 2 valves, standard for 2 manometric flames, and rotating mirror. Koenig. Kohl. ca.	Mk. 120.00
13. 9 galvanized iron open pipes: c^1-c^2 . Made to order.	\$10.00
14. Bellows-table for 3 reed-boxes. Appunn.	Mk. 120.00
15. Reed-box, vs. 512-1024 (unit of diff. 4 vs.). Appunn.	Mk. 350.00
16. Reed-box, with musical intervals, 400-800 vs. Appunn.	Mk. 150.00
17. Reed-box, giving 9 overtones of C of 64 vs. Appunn.	Mk. 70.00
18. Reed-box, C of 64 vs. Appunn.	Mk. 24.00
19. Harmonical, giving 24 overtones of C of 64 vs., and 16 of c of 128 vs. Ellis. Moore.	£ 10.0.0
20. Square piano. Bought in Ithaca.	\$100.00
21. Differential sonometer, with key and weights. Marloye. Koenig.	Fr. 112.00
22. Simple sonometer, with weights. Gillis & Gleeson.	\$3.75
23. 12 forks on resonance-boxes: $c-e^3$. Koenig.	Fr. 485.00
24. 4 forks on resonance-boxes: d^1-b^1 . Koenig.	Fr. 140.00
25. a^1 fork on resonance-box, official French standard. Koenig.	Fr. 35.00
26. 2 c -forks, 128 vs., with riders. Appunn.	Mk. 70.00
27. 4 forks (c^1, e^1, g^1, c^2) on resonance-boxes. Appunn.	Mk. 70.00
28. 7 forks (800-801 vs.) on resonance-boxes. Appunn.	Mk. 96.00
29. 33 forks (2,048-49,152 vs.). Appunn.	Mk. 170.00
30. 11 forks (2,000-45,000), with sliding resonator and ear-tube. Kessel. Appunn.	Mk. 60.00
31. c^2 fork (512 vs.). Blake. Meyrowitz.	\$1.50
32. 'Universal' fork, giving semitones. Ziegler.	\$1.10
33. 2 c^2 -forks. each	\$.25
34. 2 a^1 -forks. each	\$.30
35. Large fork, 16-25 vs. (C_2-G_1). Koenig.	Fr. 300.00
36. 8 forks, 3,840-4,096 vs. (b^4-c^5), in case, with tripod-stand. Koenig.	Fr. 340.00
37. Electro-magnetic fork. c^2 . Koenig.	Fr. 100.00
38. Electro-magnetic fork, wet contact. 50 vs. Petzold.	Mk. 80.00
39. Electro-magnetic fork. 50 vs. Chicago Laboratory Supply Co.	\$20.00
40. Electro-magnetic fork. 100 vs. Koenig.	Fr. 100.00

41.	Electro-magnetic fork. <i>a</i> ¹ . Kohl.	Fr.	35.00
42.	Electro-magnetic fork. <i>c</i> ¹ . Kohl.	Fr.	40.00
43.	13 wire forks, 8-56 vs., on resonance handles. Appunn.	Mk.	130.00
44.	14 cylindrical resonators. Koenig.	Fr.	380.00
45.	13 Quincke's tubes. Ziegler.		\$2.00
46.	Apparatus for continuous tone-change, table, 2 cylinders, variator, 4 flasks, compressed air-tank, air-pump. Stern. Oehmke.	ca.	\$100.00
47.	Galton whistle. Koenig.	Fr.	20.00
48.	Tone-tester (differential pitch-pipe). Gilbert. Will-young.		\$6.00
49.	Siren, with four rows of holes and counter. Dove. Kohl.	Mk.	85.00
50.	Pendulum, with small fork, for demonstration of tonal after-image. Sanford. Willyoung.		\$16.00
51.	3 bows, set of piano-hammers, rubber-headed mallet, duplicate rubber hammer, etc., for actuating forks.		\$5.00
52.	Steel vibrator, 4-24 vs. Appunn.	Mk.	15.00
53.	Xylophone, 2 octaves; with four strikers.		\$1.50
54.	Electric phonograph, with 6-way tube, brass horn, speaker, recorder, 16 records, 24 blank cylinders, etc. Edison. Nat. Phonograph Co.		\$90.00
55.	Foot-bellows for actuating galvanized iron pipes. Eimer & Amend.		\$8.00

IV. Auditory Perception, Memory, etc.

56.	2 simple metronomes. Petzold.	each Mk.	7.50
57.	Simple metronome. Willyoung.		\$3.75
58.	Metronome with mercury contacts. Kronecker. Petzold.	Mk.	36.00
59.	Interrupter-clock, cased. Baltzar. Zimmermann.	Mk.	170.00
60.	2 telephone snappers (pony receivers). Queen.	each	\$.90
61.	Time-sense disc (Meumann, old pattern), with attachments to Petzold kymograph. Zimmermann.		[New pattern: Mk. 280.00]
62.	4 (old pattern) and 6 (new pattern) contacts, with 4 contact-radii, for time-sense disc. Zimmermann.	each Mk.	10 to 21
63.	Localization of sound apparatus. Titchener. Michigan App. Co.		\$16.00

V. Charts, etc.

64. 2 modulator charts. Silver, Burdette & Co.
65. 2 charts, showing differences of temperament and vibration ratios of medical intervals. Made in Ithaca. Framed.
66. Chart to illustrate Ellis Harmonical. Framed.
67. Tableau général des nombres des vibrations de la série des sons musicaux. Koenig. Framed.

See also H, IV.

B. PHYSIOLOGICAL AND PSYCHOLOGICAL OPTICS.

I. Anatomy and Physiology of the Visual Organs.

1. Large clastic model of human eye. Auzoux. Fr. 75.00
2. Ophthalmotrope. Helmholtz. Krille. Mk. 64.00
3. Two dissections of eye of bullock.

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| 4. | Test-cards for astigmatism. Green. Queen. | \$5.00 |
| 5. | Test for acuity of vision. Thomson. Queen. | \$1.50 |
| | See also H, III and IV. | |

II. Visual Sensation: Intensity.

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| 6. | Working model of photometer. Bunsen. Gillis & Gleeson. | \$1.70 |
| 7. | Large photometer. Bunsen. Made in Ithaca. | \$20.00 |
| 8. | Spectrophotometer. Cambridge Instr. Co. | \$15.00 |
| 9. | Episkotister. Krille. | Mk. 25.00 |
| 10. | *Episkotister. Krille. ¹ | Mk. 15.00 |

III. Visual Sensation: Quality.

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|-----|--|-----------|-----|---------|
| 11. | 3 electrical color-mixers. Zimmermann. | each | Mk. | 30.00 |
| 12. | 3 electrical color-mixers. Made in Ithaca. Porter motor. | each | | \$1.50 |
| 13. | 3 clock-work color-mixers. Krille, new model. | each | Mk. | 75.00 |
| 14. | Electrical color-mixer, adjustable during rotation. Marbe. Zimmermann. | | Mk. | 240.00 |
| 15. | Indirect vision color-mixer. Hering. Rothe. | | Mk. | 147.00 |
| 16. | Mechanical demonstration color-mixer. Wundt. Krille. | | Mk. | 140.00 |
| 17. | Electrical demonstration color-mixer. Elbridge El. Co. | | | \$30.00 |
| 18. | Color-mixer. Lambert. Made in Ithaca. | | | \$3.00 |
| 19. | Pseudoptics. Münsterberg. Bradley. | | | \$5.00 |
| 20. | 24 doz. color discs. Hering. Rothe. | | | |
| | (1) 11 cm. diam., per doz. | pf. 30 to | | 65 |
| | (2) 20 cm. diam., per doz. | pf. 80 to | Mk. | 1.90 |
| 21. | 12 doz. color-discs. Wundt. Zimmermann. | 2 sizes. | Mk. | 17.25 |
| 22. | 12 demonstration color-discs, 60 cm. diam. Wundt. Krille. | | Mk. | 35.00 |
| 23. | Full set colored and gray papers. Bradley. | | | |
| 24. | 100 discs, illustrating 'spectrum top.' Ives, and made in Ithaca. | ca. | | \$15.00 |
| 25. | 2 doz. skeleton discs, for gelatines. Zimmermann. | ca. | Mk. | 5.00 |
| 26. | 3 sets gelatine sheets. Kirschmann. Krille, Zimmermann. | ca. | Mk. | 12.00 |
| 27. | 12 pupils' color-tops. Bradley. | | | \$.50 |
| 28. | Double-axle mechanical color-mixer. Zimmermann. | | Mk. | 65.00 |
| 29. | Spectrum chart. Framed. Prang. | | | \$1.00 |
| 30. | Chart of pure spectrum scales. Framed. Bradley. | | | \$.50 |
| 31. | Standard of color. Prang. | | | \$.50 |
| 32. | Iceland spar. Ziegler. | | | \$.50 |
| 33. | Full set gray papers. Hering. Rothe. | | | |

IV. Visual Sensation: Contrast, Color-blindness, etc.

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|-----|---|-----|-----|---------|
| 34. | Demonstration after-image apparatus. Wundt. Krille. | | Mk. | 60.00 |
| 35. | Stroboscope, with 12 photographic strips. Anschütz. Kohl. | ca. | Mk. | 21.00 |
| 36. | Artificial waterfall. Bowditch. Made in Ithaca. | | | \$4.00 |
| 37. | 6 double stroboscopic discs. Stampfer. Trentsensky. | Fl. | | 3.00 |
| 38. | Wall-campimeter. Ca. 4 x 2 m. Black and white surfaces. Made in Ithaca. | | | \$10.00 |
| 39. | Perimeter. Badal. Queen. | | | \$17.50 |

¹ The asterisk denotes that the instrument is not the property of the laboratory.

40.	5 gray screens to III. 15, <i>q. v.</i>	
41.	Demonstration contrast cards. Made in Ithaca.	
42.	6 contrast discs. Helmholtz. Made in Ithaca.	
43.	500 colored paper-rings. Hailmann. Bradley.	\$.40
44.	Screens and discs for quantitative determination of brightness contrast. Made in Ithaca.	
45.	Test-worsted for color-blindness. Galton. Cambridge Instr. Co.	£3.10.0
46.	100 worsteds. Holmgren. Queen.	\$6.00
47.	Instrument for testing color-blindness. Hering. Rothe.	Mk. 100.00
48.	Binocular color mixer. Hering. Rothe.	Mk. 40.00
49.	Simultaneous contrast apparatus. Hering. Rothe.	Mk. 28.00
50.	Mirror contrast apparatus. Hering. Rothe.	Mk. 35.00
51.	Binocular shading apparatus. Hering. Rothe.	

V. Visual Perception.

52.	Apparatus for testing relative legibility of words and letters. Made in Ithaca.	\$10.00
53.	Printed words and letters for use with above. Wood.	\$2.00
54.	Screen for demonstration of Listing's law of eye-movement. Ca. 2.25 x 3 m. Made in Ithaca.	\$15.00
55.	Instrument for estimation of angles. Galton. Cambridge Instr. Co.	£2.0.0
56.	Eye-measurement screen. Münsterberg. Elbs.	\$22.00
57.	Eye-measurement screen. Made in Ithaca.	\$8.00
58.	Cards for optical illusion. Knox & Watanabe.	
59.	.6 wire-models, showing Müller-Lyer illusion.	
60.	Wheatstone stereoscope and telestereoscope. Sanford model. Whitney.	\$10.00
61.	Tropostereoscope. Ludwig. Petzold.	Mk. 34.00
62.	Album des centres nerveux. Debierre and Doumer. Alcan.	Fr. 20.00
63.	Mirror pseudoscope. Stratton. Made in Ithaca.	\$3.00
64.	Pseudoscope. Michigan App. Co.	\$12.00
65.	Perspectoscope. Perspecto Mfg. Co.	\$2.00
66.	Hand stereoscope. (Perfecscope). Underwood.	\$1.50
67.	Hand stereoscope (stereoscope model). Petzold.	Mk. 8.50
68.	36 stereoscopic slides, with explanatory text. Martius-Matzdorff. Eckenrath.	Mk. 6.00
69.	12 stereoscopic slides, illustrating lustre. Martius-Matzdorff. Eckenrath.	Mk. 3.50
70.	18 selected stereoscopic slides. Jarvis, etc.	
71.	8 stereoscopic lunar photographs. De la Rue. Petzold.	Mk. 3.00
72.	10 selected stereoscopic slides for study of distance in inverted landscape. Braun, etc.	
73.	24 diagrammatic slides, after Wundt and Hering. Made in Ithaca.	
74.	Celluloid slides, for free stereoscopy. Made in Ithaca.	
75.	Monocular fall-apparatus. Hering. Made in Ithaca.	\$2.50
76.	Horoptyer model. Ludwig. Petzold.	Mk. 150.00
77.	Apparatus for demonstration of Listing's law of eye-movement. Ludwig. Petzold.	Mk. 30.00
78.	Large horoptyer model. Sanford, after Hering. Clark Lab.	\$15.00
79.	Model of field of regard. Sanford, after Helmholtz. Whitney.	\$30.00
80.	Apparatus for perception of forms liminally different	

- from their background. After Leuba. Made in Ithaca. \$5.00
81. Apparatus for mapping retinal circulation by ent-optic vision. Made in Ithaca. \$5.00
82. 30 sets blind-spot cards. Scripture. Willyoung. each \$.15

VI. Visual Association, Memory, etc.

83. Material for study of mediate association. Howe. Collected in Ithaca.
84. Material for study of problems in individual psychology. Sharp. Collected in Ithaca.
85. Drop-apparatus, exposing series of letters, etc. Jastrow. Garden City Model Wks. \$12.00
86. Dark chamber, table, asbestos lantern-cover, screens, reflectors, head-rest, etc., for study of association. Partly after Scripture. Made in Ithaca.
87. 30 selected lantern-slides, plain and colored, for study of association, memory, etc. Colt, etc. \$20.00
88. 20 wood models for study of memory of visual form. Made in Ithaca.
89. 3 small tanks for colored liquids (color memory). Made in Ithaca. each \$1.00

VII. General Optical Apparatus and Materials.

90. Spectroscope. Société génèvoise. Fr. 300 00
91. Reading telescope. Cambridge Instr. Co. £50.0
92. Lens of crown glass, on elevating brass stand, 5 in. diam. Queen. \$11.00
93. Equilateral prism, on elevating brass stand, 5 in. length. Queen. \$11.00
94. Glass prism, equilateral, with cut handles, 6 in. Ziegler. \$.60
95. Porte-lumière. Ritchie. \$5.00
96. *Photographic lens. \$5.00
97. Triple diaphragm, with mm. scales. Kirschmann. Krille. Mk. 45.00
98. 2 plane mirrors, ca. 40 x 25 cm. each \$2.00
99. 2 sets of colored glass plates. Krille. Mk. 15.00
100. Black tubes, metal and card, with diaphragms. \$5.00
101. Large cloth screens, 2 black, 2 white. \$8.00
102. Photographic camera. \$30.00
103. Magnesium lamp, with reflector and tape. Eimer and Amend. \$3.00
104. Photographic time and instantaneous pneumatic shutter. Queen. \$6.50
105. 2-in. diam., 8-in. focus, biconcave and biconvex lenses. Ritchie. \$2.50
106. *12 lantern slides in case.
107. 6 small and 2 large Geissler tubes. Ziegler. \$6.50
108. Dark box for above. Made in Ithaca. \$1.00
109. Dark box. Sanford. Made in Ithaca. \$4.00
110. Projection lantern, with oil-burner, 2 Welsbach gas burners, 2 arc lamps. Eimer and Amend, etc. \$18.00
111. Criterion projection lantern, with automatic arc lamp. Colt. \$112.00
112. Adjustable stand for above. Gennert, modified. \$20.00

113.	Ground glass screen, ca. 1 x 1.5m., with adjustable shutters, for lantern-slide projection.	\$18.00
114.	Dark chamber, sink, ruby window, chemicals, for developing photographs.	
115.	Convex-concave mirror. Ziegler.	\$2.25
116.	*Histological-mineralogical microscope, with accessories. Leitz.	ca. Mk. 800.00
117.	*Microscope lamp. Eimer and Amend.	\$6.00
118.	*Collection of 400 microscope slides of brain, sense-organs, etc.	
119.	Set of drawing instruments, 2 dotting pens, drawing inks, colored crayons, charcoal points, black and white cardboard, protractors, 12 pairs dividers, limb extensions, celluloid squares and curves, 12 paper mm. scales, 15 wooden mm. scales, architects' paper, drawing blocks, cross-ruled paper, colored spectacles, ground and milk glass, etc.	

C. HAPTICS AND ORGANIC SENSATION.

I. Haptical, etc., Sensations: Intensity.

1.	Pressure balance. Scripture. Willyoung.	\$8.00
2.	Minimal weights. Scripture. Willyoung.	\$3.00
3.	9 weights for method of right and wrong cases. Jastrow. Garden City Model Works.	\$8.50
4.	16 weights. Scripture. Willyoung.	\$4.00
5.	30 Weights. Galton. Cambridge Instr. Co.	£ 5.0.0
6.	2 glass funnels, with weights of shot.	
7.	6 wooden cylinders for loading with shot. each	\$.25
8.	Wooden egg for loading with shot.	\$1.00
9.	Set of 100 cartridge weights. Sanford. Made in Ithaca.	\$2.50
10.	Set of 120 envelope weights. Sanford. Made in Ithaca.	\$1.00
11.	Pressure balance. Von Frey. Zimmermann.	Mk. 40.00
12.	Algesimeter. Cattell. Brown.	\$15.00

II. Haptical, etc., Sensations: Quality.

13.	4 pressure pencils. Scripture. Willyoung. each	\$1.35
14.	8 pressure pencils. Made in Ithaca. each	\$.05
15.	Apparatus for exploring cutaneous surface. Washburn. Krille.	Mk. 50.00
16.	2 atomizers for inducing anæsthesia. each	\$1.00
17.	Menthol pencil.	\$.10
18.	Improved kinesiometer, with attachments and arm-rest. Hall. Yale Lab.	\$100.00
19.	4 temperature tubes. Scripture. Willyoung. each	\$2.00
20.	12 temperature cylinders. Goldscheider. Made in Ithaca.	\$3.00
21.	1-gal. copper vessel, fitted with two Roux regulators and 3 Friedrich burners.	
22.	2 thermometers, graduated in degrees,—24 to +200° C. Eimer & Amend. each	\$1.75
23.	Thermometer, graduated in degrees,—25 to +250° C. Eimer & Amend.	\$2.00
24.	Thermometer, graduated in tenths of degrees,—7 to +100° C. Eimer & Amend.	\$4.00
25.	Thermometer, graduated in degrees,—10 to +250° C. Eimer & Amend.	\$1.75

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| 26. | Upright physiological inductorium. Du Bois-Reymond. Petzold. | Mk. | 120.00 |
| 27. | 1 bipolar electrode; 1 unipolar electrode; 1 plate electrode. Chloride of Silver Dry-plate Battery Co. | | \$5.00 |

III. *Haptical, etc., Perception.*

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| 28. | Apparatus for perception of movement by the elbow. Sanford. Willyoung. | | \$8.00 |
| 29. | Set of blocks and points for filled and open space. Titchener. Krille. | Mk. | 10.00 |
| 30. | 23 rubber strips for estimation of extent by the skin. Titchener. Made in Ithaca. | | \$.50 |
| 31. | Interrupted-extent apparatus. Titchener. Willyoung. | | \$20.00 |
| 32. | Set of glass and rubber forms for determination of cutaneous form-limina. Major. Eimer & Amend. | | \$5.00 |
| 33. | 12 surfaces for cutaneous impression. Made in Ithaca. | | \$1.00 |
| 34. | Set of charcoal points, with sharpener, for localization experiments. | | \$1.00 |
| 35. | 4 rods, 5 handles, 2 cups, etc., for study of eccentric projection. | | \$5.00 |
| 36. | Stationary apparatus for study of eccentric projection. Made in Ithaca. | | \$5.00 |
| 37. | Rectilineal arm-movement apparatus. Münsterberg. Elbs. | | \$45.00 |
| 38. | Combined tilt-board and rotation-table. Titchener. Willyoung. | | \$50.00 |
| 39. | Set of 7 needle-æsthesiometers. Washburn. | | |
| 40. | 4 simple æsthesiometers. Scripture. Willyoung. each | | \$2.00 |
| 41. | Dynamometrical æsthesiometer. Griesbach. Brändli. | | \$17.00 |
| 42. | 2 bristle æsthesiometers. Von Frey. Zimmermann. | | |
| 43. | 2 slide æsthesiometers. Washburn. Brown & Sharpe. each | Mk. | 45.00 |
| 44. | 2 pain æsthesiometers. each | | \$20.00 |
| 45. | Materials for study of perception of liquidity. each | | \$1.00 |
| 46. | 5 frames for 'facial vision.' Made in Ithaca. | | \$2.50 |
| 47. | Steadiness gauge. Scripture. Willyoung. | | \$6.00 |

IV. *Anatomy and Physiology of Organ of Static Sense.*

48. Dissection of semi-circular canals of pike.
See also A, I, 1, 2.

V. *Charts, etc.*

49. Plate of haptical instruments. From Amer. Journ. of Psychol. VI, 3, VII, 1. Framed.
50. Chart showing localization of cutaneous impressions. From Amer. Journ. of Psychol., VII, 1. Framed.
See also H, IV.

D. TASTE AND SMELL.

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|----|--|-----|--------|
| 1. | Double olfactometer. Scripture. Willyoung. | | \$3.00 |
| 2. | 2 clinical olfactometers. Zwaardemaker. Harting Bank. each | F1. | 4.00 |
| 3. | Double clinical olfactometer. Petzold. | Mk. | 16.00 |
| 4. | Standard double fluid-mantle olfactometer. Zwaardemaker. Harting Bank. | F1. | 42.00 |

5.	Metal mirror, 3 bell jars, glass alcohol-lamp, set of duplicate glass tubes, etc., for olfactometric work.	\$15.00
6.	18 olfactory cylinders for clinical olfactometer. Gamble. Made in Ithaca.	ca. \$10.00
7.	13 standard solutions for fluid-mantle olfactometer. Gamble. Made in Ithaca.	ca. \$10.00
8.	Set of 24 fruit flavors for taste experiments. Royce.	\$4.00
9.	Set of 30 solutions for taste experiments. Made in Ithaca.	ca. \$5.00
10.	Set of 29 samples of essential oils, etc., for olfactory work. Fritzsche.	
11.	Set of 80 solutions for olfactory work. Made in Ithaca.	ca. \$5.00
12.	Barometer. Ziegler.	\$8.00
13.	Set of solutions for mixed tastes and false tastes (burning, pricking, etc.). Made in Ithaca.	\$3.00
14.	Enlarging mirror. See Vision VII, 115.	
15.	Camel's-hair brushes, small and large phials, burettes (Bausch & Lomb), pipettes (Eimer & Amend), rubber corks, caraffe and glasses, earthenware vessels, hard rubber syringes, etc., etc.	ca. \$25.00
16.	Enlarged photograph of tip of tongue, showing papillæ. Oehrwail. Framed.	\$1.00
17.	Preparation of tongue of calf, showing papillæ.	

E. AFFECTIVE PROCESSES.

I. Special Instruments.

1.	Combined spring and weight ergograph. Cattell. Horstmann.	\$35.00
2.	Weight ergograph. Mosso. Willyoung.	\$45.00
3.	Tridimensional movement analyzer. Sommer. Schmidt.	Mk. 85.00
4.	Sphygmograph, with complete set of attachments and arm-rest. Von Frey. Zimmermann.	Mk. 200.00
5.	Laryngograph. Verdin.	Fr. 60.00
6.	Pneumograph. Verdin.	Fr. 50.00
7.	Pneumograph. Sumner.	\$2.50
8.	Dynamograph. Verdin.	Fr. 130.00
9.	Hand Dynamometer. Collin. Zimmermann.	Mk. 27.50
10.	Automatograph. Made in Ithaca.	\$2.00
11.	Plethysmograph. Lombard. Michigan App. Co.	\$16.00
12.	Sphygmomanometer. Mosso. Verdin.	Fr. 190.00
13.	Plethysmograph. Franck. Verdin.	Fr. 30.00
14.	2 spring balances (for dynamometry). Chatillon. Ziegler.	each \$1.25

II. Models, etc.

15.	Model of course of emotion. Wundt. Made in Ithaca.	\$2.00
16.	4 masks illustrating expression of emotion. Hennecke.	\$5.25
17.	8 photographs illustrating expression of emotion. Framed. Soule.	\$1.60
18.	Bust of Femme inconnue. Donatello. Caproni.	\$6.00

III. General (Recording) Instruments and Materials.

19.	Recording chronometer. Jacquet. Verdin.	Fr. 170.00
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20.	Large endless-paper kymograph for 9-in. paper. Francis.	\$120.00
21.	Endless-paper kymograph, with 2 drums, clock-work movement; all accessories. Ludwig. Petzold.	Mk. 900.00
22.	Simple kymograph, weight attachment. Petzold.	Mk. 85.00
23.	Small clock-work kymograph. Zimmermann.	Mk. 185.00
24.	Double set of tambours. Marey. Krille.	each Mk. 40.00
25.	30 writing-points (metal, glass, bamboo). Zimmermann.	Mk. 13.00
26.	Set of glass, metal and porcelain T-ways and Y-tubes for rubber tubing.	
27.	Rubber tubing, various sizes.	
28.	Deprez time-marker. Zimmermann.	Mk. 75.00
29.	Simple time-marker. Petzold.	Mk. 28.00
30.	Simple time-marker. Krille.	Mk. 9.00
31.	Clock-work chronograph, with tuning-fork and hammer controls. Wundt. Zimmermann.	Mk. 1,180.00
32.	Glazed paper for kymographs and chronograph.	
33.	Varnishing tray, etc., for smoked records. Made in Ithaca.	\$5.00
34.	Adjustable stand for revolving drums for smoking. Von Frey. Zimmermann.	Mk. 50.00
35.	Triple fan-flame gas-burner for smoking drums. Chicago Laboratory Supply Co.	\$.85

F. ACTION.

I. Special Instruments.

1.	7 vernier chronoscopes with attachments. Sanford. Whitney.	\$35.00
2.	2 Hipp chronoscopes, new pattern. Krille.	each Mk. 280.00
3.	Large control hammer. Wundt. Krille.	Mk. 290.00
4.	Voice-key with relay. Cattell. Krille.	Mk. 102.00
5.	Lip-key. Cattell. Krille.	Mk. 22.50
6.	Finger-key. Dessoir. Yale Lab. [Zimmermann.	Mk. 32.00]
7.	Five finger key. Jastrow. Garden City Model Works.	\$7.50
8.	Fall apparatus. Appunn. Krille.	Mk. 135.00
9.	2 electro-magnetic sound hammers. Wundt. Krille.	each Mk. 47.50
10.	Large pyramidal pendulum for light stimuli. Krille. [Improved form, Zimmermann.	Mk. 480.00]
11.	Stimulator, with set of rubber forms, for cutaneous reactions. Titchener. Whitney.	\$7.50
12.	7 simple reaction-keys. Krille. Zimmermann.	
		each Mk. 10.00-Mk. 35.00
13.	Electric-pneumatic reaction-key. Zimmermann.	Mk. 35.00
14.	Electric-pneumatic pen. Henry. Zimmermann.	Mk. 24.00

II. General Instruments and Materials.

15.	10 commutating keys. Zimmermann.	each Mk. 15.00-Mk. 30.00
16.	2 German-silver wire rheochords. Krille.	each Mk. 20.00
17.	Wire, various sizes.	
18.	3 wall-diagrams, with text, illustrating Hipp chronoscope. Framed. Made in Ithaca.	

See also Affective Processes, III. General Supplies.

G. ATTENTION.

1. Demonstration fall-chronometer. Wundt. Krille. Mk. 48.00
2. Complication apparatus. Wundt. Krille. Mk. 175.00
3. Set of discs for fluctuations of attention. Made in Ithaca.
4. Set of photographic word-slides, for apperception. Pillsbury. Made in Ithaca.
5. Exposure apparatus. Jastrow. Garden City Model Works, \$8.50
See also A, IV; B, V, VI; C, III; D; E, I, III; F, I.

H. GENERAL SUPPLIES.

I. Electrical Outfit.

1. Simple galvanometer. Queen. \$5.00
2. Telephone, with attachments. Ziegler. \$18.00
3. 7 electric bells, with push-buttons.
4. Cherry voltmeter and ammeter. each \$1.50
5. Current tester. Krille. Mk. 4.50
6. 24 incandescent lamps, various sizes, with receptacles, switches, etc., for resistance.
7. 7 Daniell cells. \$14.00
8. 12 Leclanché cells. \$12.00
9. 3 Meidinger gravity cells. Mk. 19.50
10. 3 Edison-Lalande cells. \$9.75
11. 24 Fleischl cells, in cases. Mk. 100.00
12. 2 chloride accumulators. \$28.00
13. 20 lbs. quicksilver. \$15.00
14. Large tinned-iron rheostat. Nichols. Made in Ithaca. \$3.50
15. 2-in. spark induction coil. Ziegler. \$34.10
16. Sliding brass wire rheostat. Horstmann. \$5.00
17. 12 doz. connectors. \$12.00
18. 12 doz. binding posts. \$12.00
19. Five-point switch. Queen. \$.75
20. 30-fold system of wires, connecting rooms.
21. Direct current, 110 volts, in 7 rooms; switches and glass-doored switch cases. (Day current).
22. Illuminating system, alternating current, 110 volts, in all rooms. (Night current.)
23. Crocker-Wheeler motor, $\frac{1}{2}$ H. P., 1600 r. p. m., 115 v. \$22.50
24. Speed reducer. Pillsbury. Michigan App. Co. \$12.00
25. Combined dynamo and motor model. Elbridge El. Co. See Vision, III, 17.

II. Mechanical and Chemical Outfit.

26. 14 standards; 11 arms; 18 clamps; 4 rubber clamps; 12 pulleys. Eimer & Amend, White, Petzold, etc. \$45.00
27. 4 oil lamps.
28. 2 Bunsen burners. each \$.50
29. 4 Friedrich burners.
30. Glass-ware, various.
31. Full set carpenter's tools.
32. Gas in 5 rooms.
33. Water in 3 rooms.
34. 3 adjustable chairs. each \$5.00
35. Couch. \$15.00

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| 36. | 8 instrument cases; 2 chart cases; 2 battery and store cupboards. | |
| 37. | Water motor. Zimmermann. | Mk. 12.50 |
| 38. | 2 gals. each sulphuric and nitric acid; 1 gal. each turpentine, hydrochloric acid, odorless paraffin, absolute alcohol. | |
| 39. | Ether; shellac and alcohol varnish; machine oil; lamp-black; rubber cement, etc., etc. | |
| 40. | Quarter-second stop-watch. | \$6.00 |
| 41. | Fifth-second stop-watch. | \$6.00 |
| 42. | Fifth-second stop-watch. | \$6.50 |
| 43. | Chemical balance with weights. Eimer & Amend. | \$49.00 |
| 44. | Cotton wool; cloth; wood for models, etc.; wood and card boxes; twine, silk; glue, paste, mucilage; oakum, waste; spare gas-pipes; leather, various sorts; wax, various sorts; cardboard instrument covers, all sizes; etc., etc. | |

III. Physiological and Anatomical Outfit.

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| 45. | *Case of physiological instruments. | |
| 46. | Case of physiological instruments. | |
| 47. | Odd physiological instruments (scissors, scalpels, etc.) | |
| 48. | Large elastic model of brain. Auzoux. | Fr. 300.00 |
| 49. | Set of 10 brain models. Steger. | Mk. 64.00 |
| 50. | *Articulated skull, with restoration of ear. | |
| 51. | *Series of 12 brains. | |
| 52. | 12 wall diagrams (colored) of brain and sense-organs. From Wenzel, Anatomischer Handatlas. Stauffer. Framed. | Mk. 16.00 |
| 53. | *Epitome of cranial nerves. Rider, after Heiberg. Framed. | |

IV. Diagrams, etc.

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| 54. | 3 large photographs of first psychological laboratory of Cornell University. Framed. | |
| 55. | Chart to illustrate metric system. Amer. Metrol. Soc. Framed. | |
| 56. | Set of 50 wall-diagrams to illustrate Course in Systematic Psychology. | |
| 57. | Series of 35 psychological portraits. Open Court Pub. Co. Framed. | \$7.75 |
| 58. | Large platinotypes of Wundt and Fechner. Bellach. Framed. | each Mk. 60.00 |
| 59. | Etched portrait of Chas. Darwin. Hollyer. Keppel. Framed. | \$1.00 |
| 60. | *40 frames of psychological portraits, autographs, etc. | |
| 61. | Bust of Aristotle. Hennecke. | \$7.50 |
| 62. | Portraits of Helmholtz and Donders from Arch. f. Ophthalmologie. Framed. | \$2.00 |

Various instruments, now on order or in the making, have been omitted from the above list. Nothing is said, in particular, of the series of simple pieces which is in course of construction for the writer by the Chicago Laboratory Supply Co. A special circular, describing these pieces, will shortly be issued by the firm.